

Appl. No. 10/810,533

Attorney Docket No.: N1085-00261 [TSMC2003-1117]

Amdt. dated 02/15/2006

Reply to Office Action of 11/16/2005

**Amendments to the Claims:**

This listing of claims will replace all prior versions and listings of claims in the application:

- 1 1. (Currently Amended) A method for mapping surface topography of a substrate  
2 comprising:  
3 forming a non-metallic film over a metal-free substrate;  
4 forming a single metal film over said non-metallic film, said metal film not being a  
5 refractory metal;  
6 polishing to remove at least a portion of said metal film; and  
7 distinguishing first regions in which said metal film remains, from second regions  
8 in which said metal film has been removed and said non-metallic film is exposed, by  
9 directing a beam of an optical signal to scan across a top surface of said substrate at a  
10 plurality of locations and in a plurality of arcuately spaced directions.
- 1 2. (Original) The method as in claim 1, wherein said forming a non-metallic film over  
2 a substrate comprises forming a dielectric film over a semiconductor substrate.
- 1 3. (Original) The method as in claim 1, wherein said substrate includes at least one  
2 further film formed thereover, and said forming a non-metallic film comprises forming a  
3 dielectric film over said at least one further film.
- 1 4. (Original) The method as in claim 3, wherein said at least one further film  
2 includes a patterned polysilicon film and a polished interlevel dielectric film formed  
3 thereover.
- 1 5. (Currently Amended) The method as in claim 3, ~~wherein said polishing and said~~  
2 ~~distinguishing take place during in-line processing of semiconductor devices being~~  
3 ~~formed on said substrate and~~ further comprising generating two-dimensional  
4 topographical data of a surface of said substrate.

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1 6. (Original) The method as in claim 1, wherein said forming a metal film comprises  
2 forming a copper film.

1 7. (Original) The method as in claim 1, wherein said polishing comprises chemical  
2 mechanical polishing (CMP).

1 8. (Currently Amended) The method as in claim 1, wherein said distinguishing  
2 includes using an interferometer to monitor said optical signal ~~signals directed to a top~~  
3 ~~surface of said substrate.~~

1 9. (Original) The method as in claim 1, wherein said distinguishing is repeated  
2 periodically during said polishing.

1 10. (Currently Amended) The method as in claim 1, wherein said distinguishing  
2 comprises directing said beam to scan in a plurality of non-radial directions ~~is repeated~~  
3 ~~substantially continuously during said polishing.~~

1 11. (Currently Amended) The method as in claim ~~[[10]]~~ 1, wherein said distinguishing  
2 includes spatially distinguishing said first regions from said second regions a plurality of  
3 times during said polishing, and further comprising generating a three-dimensional  
4 topographical map of said substrate based on said distinguishing.

1 12. (Currently Amended) The method as in claim 1, wherein said distinguishing  
2 includes directing ~~an optical signal to a~~ a plurality of said beams to said top surface of  
3 said substrate and using an interferometer to detect one of a return refracted signal and  
4 a return reflected signal.

1 13. (Cancelled)

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1 14. (Original) The method as in claim 1, further comprising generating a map of  
2 substrate topography based on data obtained during said distinguishing.

1 15. (Original) The method as claim 14, further comprising instituting in-line process  
2 controls based on said map.

1 16. (Original) The method as in claim 14, wherein said first regions correspond to  
2 relatively depressed regions of said substrate and said second regions correspond to  
3 relatively raised regions of said substrate.

1 17. (Currently Amended) The method as in claim [[1]] 12, wherein said substrate is  
2 generally round and includes a diameter of about 12 inches and said distinguishing  
3 includes monitoring said optical signal at signals directed to a plurality of locations, each  
4 of said plurality of locations separated from other of said plurality of locations by about  
5 10-20 mm.

1 18. (Currently Amended) The method as in claim 1, wherein said substrate  
2 comprises a semiconductor substrate upon which a plurality of semiconductor devices  
3 are being formed, and said distinguishing includes directing said beam to scan along  
4 ~~monitoring optical signals directed to~~ a plurality of scribe lines between respective  
5 semiconductor devices of said plurality of semiconductor devices on said semiconductor  
6 substrate.

1 19. (Currently Amended) A method for mapping surface topography of a substrate  
2 comprising:  
3 forming a non-reflective film over a metal-free substrate;  
4 forming a single reflective film over said non-reflective film, said reflective film not  
5 being a refractory metal;  
6 polishing to remove at least a portion of said reflective film; and

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7 distinguishing first regions in which said reflective film remains, from second  
8 regions in which said reflective film has been removed and said non-reflective film is  
9 exposed by scanning a plurality of beams of an optical signal across a top surface of  
10 said substrate at a plurality of locations and in a plurality of arcuately spaced directions.

1 20. (Currently Amended) An apparatus for in-line monitoring of surface topography of  
2 a substrate comprising:  
3 a body for receiving a substrate thereon;  
4 polishing means for polishing a surface of said substrate;  
5 means for scanning a plurality of beams of an optical signal across a top surface  
6 of said substrate at a plurality of locations and in a plurality of different directions; and  
7 detecting means for detecting a presence or absence of ~~[[a]]~~ any reflective  
8 material film at a plurality of arcuately spaced, non-linear locations ~~[[on]]~~ of said  
9 substrate surface during said polishing operation.

1 21. (Cancelled).

1 22. (Original) The apparatus as in claim 20, wherein said detecting means comprise  
2 an interferometer.

1 23. (Original) The apparatus as in claim 20, wherein said polishing means comprise  
2 a chemical mechanical polishing apparatus.

1 24. (Currently Amended) The apparatus as in claim 20, wherein said detecting  
2 means ~~detects a presence or absence of said reflective film at a plurality of locations on~~  
3 ~~said surface,~~ several times during a polishing operation.

1 25. (Original) The apparatus as in claim 20, further comprising display means that  
2 provide an output indicative of topography of said substrate.

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- 1 26. (Original) The apparatus as in claim 25, in which said display means is coupled
- 2 to electronic circuitry that compares said output to pass/fail criteria.